

GUX-X, GUC-X, & GUD-X

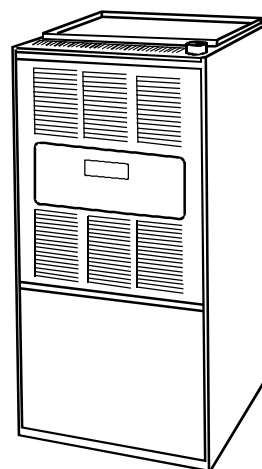
Gas-Fired Warm-Air Furnace

Installation Instructions

Affix this manual, Specification Sheet and Users Information Manual adjacent to the furnace.

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Amana Forced Air Central Furnace Design Complies With Requirements Embodied in The American National Standard / National Standard of Canada Shown Below.

ANSI Z21.47•CAN/CGA-2.3 Central Furnaces



RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION.

ATTENTION INSTALLING PERSONNEL

As a professional installer you have an obligation to know the product better than the customer. This includes all safety precautions and related items.

Prior to actual installation, thoroughly familiarize yourself with this Instruction Manual. Pay special attention to all safety warnings. Often during installation or repair it is possible to place yourself in a position which is more hazardous than when the unit is in operation.

Remember, it is your responsibility to install the product safely and to know it well enough to be able to instruct a customer in its safe use.

Safety is a matter of common sense...a matter of thinking before acting. Most dealers have a list of specific good safety practices...follow them.

The precautions listed in this Installation Manual should not supersede existing practices but should be considered as supplemental information.



WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**
- **If you smell gas:**
 - **Do not try to light any appliance.**
 - **Do not touch any electrical switch; do not use any phone in your building.**
 - **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
 - **If your gas supplier cannot be reached, call the fire department.**
- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**



WARNING

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the furnace before shutting off the electrical supply.

To The Owner

It is important that you fill out the owner's registration card and mail it today. This will assist Amana in contacting you should any service or warranty information change in the future. When filling in the registration card, be sure to include the Model, Manufacturing and Serial Numbers, plus the installation date.

Your warranty certificate is also supplied with the unit. Read the warranty carefully and note what is covered. Keep the warranty certificate in a safe place, so you can find it, if necessary.

If additional operating instructions are required, call the dealer where the purchase was made.

To The Installer

Before installing this unit, please read this manual to familiarize yourself on the specific items which must be adhered to, such as maximum external static pressure to unit, BTU input rating, air temperature rise, minimum or maximum CFM, and motor speed connections.

Keep this literature in a safe place for future reference.

I. Safety and Unit Location



WARNING

To prevent personal injury or death due to improper installation, adjustment, alteration, service or maintenance, refer to this manual or for additional assistance or information consult a qualified installer, service agency or the gas supplier.



WARNING

This product contains or produces a chemical or chemicals which may cause serious illness or death and which are known to the State of California to cause cancer, birth defects or other reproductive harm.



WARNING

To prevent possible death, personal injury or equipment damage due to fire, the following points must be observed when installing the unit.



WARNING

To prevent possible death, personal injury or property damage due to electrical shock, the furnace must be located to protect the electrical components from water.



CAUTION

This unit must not be used as a “construction heater” during the finishing phases of construction on a new structure. This type of use may result in premature failure of the unit due to extremely low return air temperatures and exposure to corrosive or very dirty atmospheres.

SAFETY

- When the furnace is heating, the return air temperature of the furnace must be between 55°F and 100°F.
 - Furnaces installed in areas frequently contaminated by:
 - permanent wave solutions
 - chlorinated waxes or cleaners
 - chlorine based swimming pool chemicals
 - water softening chemicals
 - deicing salts or chemicals
 - carbon tetrachloride
 - halogen type refrigerants
 - cleaning solutions (such as perchloroethylene)
 - printing inks
 - paint removers
 - varnishes
 - hydrochloric acid
 - cements and glues
 - antistatic fabric softeners for clothes dryers
 - and masonry acid washing materials
- must be sealed to prevent contaminated air from reaching the furnace. The furnace must still have an adequate supply of combustion air, either from a nearby uncontaminated room or from outdoors. For details, see “AIR REQUIREMENTS” Section III.
- Provisions must be made for intake of combustion air (GUD) and venting combustion products outdoors through proper venting systems. The length of combustion air pipe (GUD) and flue pipe could be a limiting factor in locating the furnace. See Sections III and IV.
 - Allow clearances from the enclosure as shown on Specification sheet for fire protection, proper operation, and service access. These clearances must be permanently maintained. The combustion and ventilating air openings in the front and top panels of the furnace must never be obstructed.
 - When the furnace is used in connection with a cooling unit, the furnace must be upstream of, or in parallel with, the cooling unit. For details see Section VII.
 - This furnace produces condensate as it operates. Do not locate the furnace or its condensate drainage system in an area subjected to below freezing temperatures.

LOCATION

- Centralize the furnace as is practical with respect to the air distribution system.
- The furnace must be set on a level floor to enable the condensate produced to drain properly. If the floor may become wet or damp at times, the furnace should be supported above the floor on a concrete base sized approximately 1-1/2" larger than the base of the furnace.
- Do not install the furnace directly on carpeting, tile, or combustible material other than wood flooring.
- Do not install the furnace where the combustion air is exposed to the following substances:

permanent wave solutions
chlorinated waxes or cleaners
chlorine based swimming pool chemicals
water softening chemicals
deicing salts or chemicals
carbon tetrachloride
halogen-type refrigerants
cleaning solutions (such as perchloroethylene)
printing inks
paint removers
varnishes
hydrochloric acid
cements and glues
antistatic fabric softeners for clothes dryers
and masonry acid washing materials.

Exposure to contaminated combustion air will result in safety and performance-related problems.

- If the furnace is installed in a residential garage, the furnace must be positioned so that the burners and ignition source are located not less than 18 inches (457 mm) above the floor and protected from physical damage by vehicles.

II. General Information



WARNING

Possible death, personal injury or property damage due to fire, explosion, smoke, soot, condensation, electrical shock or carbon monoxide may result from improper installation, repair, operation, or maintenance on this product.



WARNING

To prevent death, personal injury or property damage due to fire, do not install this furnace in a mobile home, trailer, or recreational vehicle.

To ensure safe and efficient operation, install, operate, and maintain this upflow furnace in accordance with these installation and operating instructions, all local building

codes and ordinances, or with the latest edition of the National Fuel Gas Code, NFPA 54/ANSI Z223.1*, and/or CAN/CGA B149 Installation Codes, local plumbing or waste water codes and other applicable local codes.

The rated heating capacity of the furnace should be greater than or equal to the total heat loss of the area to be heated. The total heat loss should be calculated by an approved method or in accordance with "A.S.H.R.A.E. Guide" or "Manual J-Load Calculations" published by the Air Conditioning Contractors of America.

*Obtain from: American National Standards Institute 1430 Broadway, New York, NY 10018.

TRANSPORTATION DAMAGE

All furnaces are securely packed in shipping containers tested according to the International Safe Transit Association standards. The carton must be checked upon arrival for external damage. If damage is found, a request for inspection by carrier's agent must be made in writing immediately.

The furnace must be carefully inspected on arrival for damage and bolts or screws which may have come loose in transit. In the event of damage the consignee should:

1. Make a notation on delivery receipt of any visible damage to shipment or container.
2. Notify carrier promptly and request an inspection.
3. With concealed damage, carrier must be notified as soon as possible - preferably within five days.
4. File the claim with the following support documents within a nine month statute of limitations.
 - Original or certified copy of the Bill of Lading, or indemnity bond.
 - Original paid freight bill or indemnity in lieu thereof.
 - Original or certified copy of the invoice, showing trade and other discounts or reductions.
 - Copy of the inspection report issued by carrier's representative at the time damage is reported to carrier.

The carrier is responsible for making prompt inspection of damage and for a thorough investigation of each claim. The distributor or manufacturer will not accept claims from dealers for transportation damage.

EXISTING FURNACE REMOVAL

Note: When an existing furnace is removed from a venting system serving other appliances, the venting system may be too large to properly vent the remaining attached appliances.

The following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- (a) Seal any unused openings in the common venting system.
- (b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no block-

age or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

- (c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- (d) Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance will operate continuously.
- (e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
- (f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.
- (g) If improper venting is observed during any of the above tests, the common venting system must be corrected in accordance with the latest edition of the National Fuel Gas Code, NFPA 54/ANSI Z223.1.

If resizing any portion of the common venting system, use the appropriate table in Appendix G in the latest edition of the National Fuel Gas Code, NFPA 54/ANSI Z223.1.

THERMOSTAT LOCATION

Locate the thermostat in an area having good air circulation, about 5 feet high on a vibration-free inside wall.

Do not install the thermostat where it may be affected by:

- drafts or dead spots behind door, in corners or under cabinets.
- hot or cold air from ducts.
- radiant heat from sun or appliances.
- concealed pipes and chimneys.
- unheated (uncooled) areas behind the thermostat, such as an outside wall.

Consult the instructions packaged with the thermostat for mounting instructions. See Section IX for wiring and adjustments to thermostat.

III. Air Requirements



WARNING

Possible death, personal injury or property damage may occur if the furnace and other fuel-burning appliances are not provided with enough fresh air for proper combustion and ventilation of flue gases. Most homes require outside air to be supplied into the furnace area.

Improved construction and additional insulation in buildings has reduced the heat loss, making these buildings much tighter around doors and windows so air infiltration is minimal. This creates a problem supplying combustion and ventilation air for gas fired and other fuel burning appliances. Use of appliances pulling air out of the house (clothes dryers, exhaust fans, fireplaces, etc.) increases this problem causing appliances to starve for air.

Most homes will require outside air be supplied to the furnace area by means of ventilation grilles or ducts connecting directly to the outdoors or spaces open to the outdoors such as attics or crawl spaces.

The following information on air for combustion and ventilation is reproduced from the **National Fuel Gas Code NFPA 54/ANSI Z223.1, Section 5.3.**

5.3.1 General:

- (a) The provisions of 5.3 apply to gas utilization equipment installed in buildings and which require air for combustion, ventilation and dilution of flue gases from within the building. They do not apply to (1) direct vent equipment which is constructed and installed so that all air combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and dilution of flue gases.
- (b) Equipment shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Equipment shall be located so as not to interfere with proper circulation of air. When normal infiltration does not provide the necessary air, outside air shall be introduced.
- (c) In addition to air needed for combustion, process air shall be provided as required for: cooling of equipment or material, controlling dew point, heating, drying, oxidation or dilution, safety exhaust, odor control, and air for compressors.
- (d) In addition to air needed for combustion, air shall be supplied for ventilation, including all air required for comfort and proper working conditions for personnel.
- (e) While all forms of building construction cannot be covered in detail, air for combustion, ventilation and dilution of flue gases for gas utilization equipment vented by natural draft normally may be obtained by application of one of the methods covered in 5.3.3 and 5.3.4.
- (f) Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

5.3.2 Equipment Located in Unconfined Spaces: In unconfined spaces (see definition below) in buildings, infiltration may be adequate to provide air for combustion.

tion ventilation and dilution of flue gases. However, in buildings of tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.), additional air may need to be provided using the methods described in 5.3.3-b or 5.3.4.

Space, Unconfined. For purposes of this Code, a space whose volume is not less than 50 cubic feet per 1,000 BTU per hour of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, are considered a part of the unconfined space.

5.3.3 Equipment Located in Confined Spaces:

- (a) *All Air from Inside the Building:* The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of 1 square inch per 1,000 BTU per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure (See Figure 1).

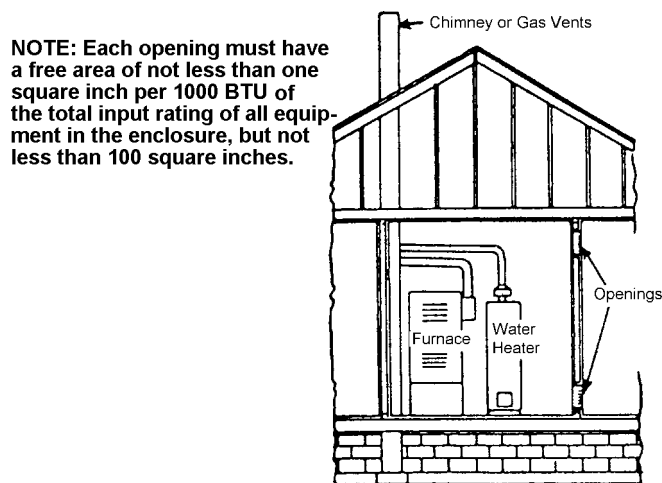


Figure 1
Equipment Located in Confined Spaces; All Air from Inside Building. See 5.3.3-a

- (b) *All Air from Outdoors:* The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (See Figure 2).

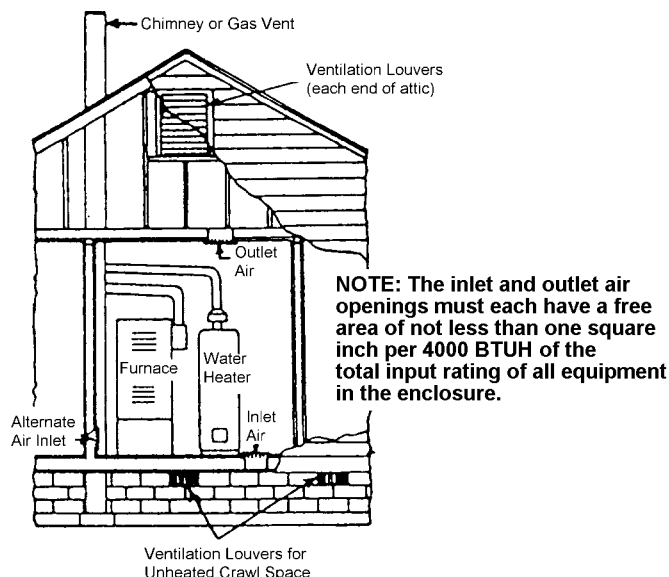


Figure 2
Equipment Located in Confined Spaces; All Air from Outdoors—Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 5.3.3-b

2. When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (See Figure 3).

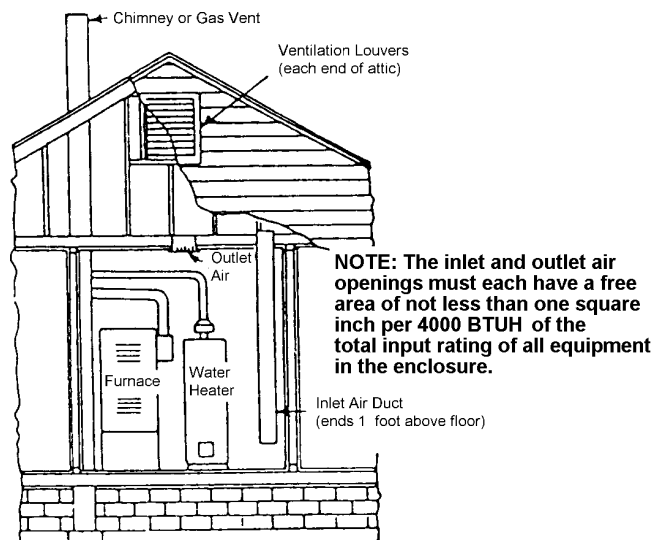
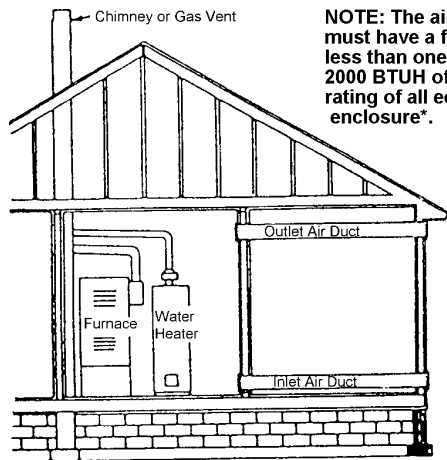


Figure 3
Equipment Located in Confined Spaces; All Air from Outdoors Through Ventilated Attic. See 5.3.3-b.

3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 BTU per hour of total input rating of all equipment in the enclosure (See Figure 4).



*If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

Figure 4
Equipment Located in Confined Spaces; All Air from Outdoors. See 5.3.3-b.

4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches.

5.3.4 Specially Engineered Installations:

The requirements of 5.3.3 shall not necessarily govern when special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation, and dilution of flue gases.

5.3.5 Louvers and Grilles:

In calculating free area in 5.3.3, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than 1/4 inch mesh. If the area through a design of louver or grille is known, it should be used in calculating the size of opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25 percent free area and metal louvers and grilles will have 60-75 percent free area. Louvers and grilles shall be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.

5.3.6 Special Conditions Created by Mechanical Exhausting or Fireplaces:

Operation of exhaust fans, ventilation systems, clothes dryers, or fireplaces may create conditions requiring special attention to avoid unsatisfactory operation of installed gas utilization equipment.

IV. Vent Pipe (All Models) and Combustion Air Pipe (GUD Models) Materials



WARNING

Failure to follow these instructions can result in bodily injury or death from asphyxiation. Therefore, carefully read and follow all instructions given in this section.

In order to achieve high efficiency, the products of combustion from this furnace are cooled to the point where condensation takes place. Consequently, the venting must be done in a different manner and with different materials than with a conventional system. Two- or three-inch PVC Schedule 40 pipe meeting ASTM D1785, PVC primer meeting ASTM F656 and PVC solvent cement meeting ASTM D2564 specifications must be used. Only DWV type fittings meeting ASTM D2665 and ASTM D3311 can be used. Carefully follow the manufacturer's instructions in cutting, cleaning, and solvent cementing of PVC or ABS pipe.

As an alternate to PVC pipe, primer, solvent cement, and fittings; ABS materials which are in compliance with the following specifications may be used: two- or three-inch ABS Schedule 40 pipe must meet ASTM D1527 and, if used in Canada, must be CSA listed. Solvent cement for ABS to ABS joints must meet ASTM D2235 and, if used in Canada, must be CSA listed. The solvent cement used for the PVC to ABS transition joint must meet ASTM D3138. Fittings must be DWV type fittings which meet ASTM D2661 and ASTM D3311 and, if used in Canada, must be CSA listed. Carefully follow the manufacturer's instructions in cutting, cleaning, and solvent cementing PVC or ABS pipes.



WARNING

Solvent cements are combustible liquids and should be kept away from all ignition sources. (i.e. sparks, open flames and excessive heat). Avoid breathing cement vapors or contact with skin and eyes.

All 90 degree elbows must be medium (1/4 bend DWV) or long radius (long sweep 1/4 bend DWV) types conforming to ASTM D3311. A medium radius (1/4 bend) elbow is 3-1/16 inch minimum from the plane of one opening to the centerline of the other opening for 2 inch pipe (4-9/16 inch for 3 inch pipe).

This furnace must not be connected to any type B, BW, or L vent or vent connector and must not be vented into any portion of a factory built or masonry chimney, except when used as a pathway for PVC pipe as described below

Flexible couplings for joining PVC pipe (sometimes called "no hub connectors") have been used by some installers to connect the field supplied portion of the vent system to the

furnace. Amana does not encourage nor recommend using these connectors. However, if you do choose to use “no-hub connectors,” the connectors must be gas tight, water tight, and able to withstand continuous exposure to the warm, moist, acidic flue products of the furnace.

It is the responsibility of the installer to follow the manufacturers’ recommendations and to verify that all flue pipe connectors used are compatible with the furnace flue products. In addition the connectors must possess adequate structural integrity to prevent flue pipe separations during furnace operation.

V. Vent Piping - GUX (All Installations), GUC (All Installations), and GUD (One Pipe Installations)

IMPORTANT: The length of the vent pipe affects the performance of the furnace and therefore must be carefully sized.

Pipe Diameter for GUC(All Models), GUX (All Models), and GUD045 (One Pipe Venting)									
# of Inside Elbows	5 to 10 feet	10 to 15 feet	15 to 20 feet	20 to 25 feet	25 to 30 feet	30 to 35 feet	35 to 40 feet	40 to 45 feet	45 to 50 feet
1	2"	2"	2"	2"	2"	2"	2"	3"	3"
2	2"	2"	2"	2"	2"	2"	2"	3"	3"
3	2"	2"	2"	2"	2"	2"	3"	3"	3"
4	2"	2"	2"	2"	2"	3"	3"	3"	3"
5	2"	2"	2"	2"	3"	3"	3"	3"	3"
6	2"	2"	2"	3"	3"	3"	3"	3"	3"
7	2"	2"	3"	3"	3"	3"	3"	3"	3"
8	2"	3"	3"	3"	3"	3"	3"	3"	3"

Pipe Diameter for GUD070 (One Pipe Venting)									
# of Inside Elbows	5 to 10 feet	10 to 15 feet	15 to 20 feet	20 to 25 feet	25 to 30 feet	30 to 35 feet	35 to 40 feet	40 to 45 feet	45 to 50 feet
1	2"	2"	2"	2"	2"	2"	2"	3"	3"
2	2"	2"	2"	2"	2"	2"	2"	3"	3"
3	2"	2"	2"	2"	2"	3"	3"	NA	NA
4	2"	2"	2"	2"	3"	3"	NA	NA	NA
5	2"	2"	2"	3"	3"	NA	NA	NA	NA
6	2"	2"	3"	3"	NA	NA	NA	NA	NA
7	2"	3"	3"	NA	NA	NA	NA	NA	NA
8	2"	3"	NA	NA	NA	NA	NA	NA	NA

Pipe Diameter for GUD090, GUD115 (One Pipe Venting)									
# of Inside Elbows	5 to 10 feet	10 to 15 feet	15 to 20 feet	20 to 25 feet	25 to 30 feet	30 to 35 feet	35 to 40 feet	40 to 45 feet	45 to 50 feet
1	3"	3"	3"	3"	3"	3"	3"	3"	3"
2	3"	3"	3"	3"	3"	3"	3"	3"	3"
3	3"	3"	3"	3"	3"	3"	3"	NA	NA
4	3"	3"	3"	3"	3"	3"	NA	NA	NA
5	3"	3"	3"	3"	3"	NA	NA	NA	NA
6	3"	3"	3"	3"	NA	NA	NA	NA	NA
7	3"	3"	3"	NA	NA	NA	NA	NA	NA
8	3"	3"	NA	NA	NA	NA	NA	NA	NA

The inside feet of straight pipe and inside elbows represent the venting system from the furnace to the inside wall. Follow termination instructions for going from the inside wall to the outside in the next paragraph.

When the vent pipe goes through an outside wall, the vent

must terminate at least one foot outside to keep moist combustion products away from the structure. The vent termination must be at least three feet above any forced air inlet located within ten feet. It must be at least four feet below, four feet horizontally from or one foot above any door, window, or gravity air inlet into any building. The vent must terminate at least one foot above ground level. If heavy snow is expected locally, this distance may need to be increased. The vent shall not terminate over public walkways, or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Drill a 2-3/8 inch diameter hole through the wall for 2 inch pipe. (For 3 inch pipe, drill a 3-1/2 inch diameter hole.) Cut a piece of PVC (ABS) pipe that is the thickness of the wall plus the depth of the sockets of the fittings to be installed on the inside and outside of the walls. To prevent the vent pipe from moving and possibly damaging connections, locate the fitting on the inside wall and a coupling on the outside wall as shown in Fig. 5. To prevent condensate from freezing inside the PVC flue pipe in extremely cold conditions or in long outdoor runs, insulation may be required on the cut side of the PVC pipe. Use 1/2 inch thickness closed cell foam insulation such as Armaflex or Insultube.

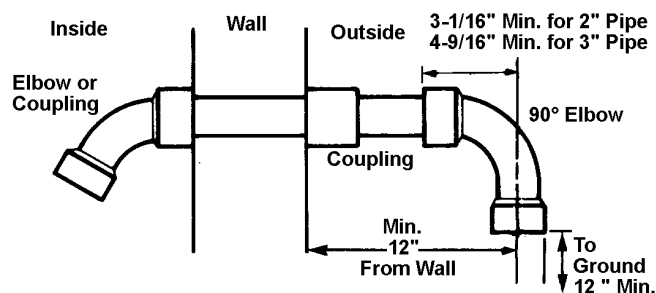


Figure 5
Horizontal Vent Termination

In a basement installation, the vent pipe may be run between the joist spaces. If the vent must go below the joists, then the pipe must run up into the last joist space to go through the header. Two 45° elbows should be used rather than 90°s. The horizontal run must not have any sag that can hold condensate and should pitch up at least 1/4 inch per foot so that condensate will run back to the unit to drain. Support the horizontal run at least every three feet. Allow for some expansion and contraction from temperature fluctuations. The normal direction changes usually account for this, but if you have a long run followed by a short offset of less than 40 inches such as going up into the last joist space, the pipe should be tightly clamped to prevent flex loading on the fittings. Seal around the pipe on the outside wall with silicone caulking material.

If the vent is to be run vertically through the roof, it must extend at least 12 inches above the roof line and shall be at least 12 inches from any vertical wall. It must terminate at least three feet above any forced air inlet located within 10 feet, and at least 12 inches from any door, window, or gravity air inlet into any building. If heavy snow is expected to remain on the roof, the clearances to vertical walls and the roof may need to be increased. The vent must be made

tight where it penetrates the roof with a proper flashing such as used with a plastic plumbing vent. The vent may be run through an existing **unused** chimney: however, the pipe must be used all the way through to at least 12 inches above the top of the existing chimney. The space between the vent pipe and the chimney must be closed with a weather tight, corrosion resistant flashing. *Never vent with an existing appliance or vent used by a solid fuel appliance.*



WARNING

Upon completion of the furnace installation, carefully inspect the entire flue system both inside and outside the furnace to assure it is properly sealed. Leaks in the flue system can result in serious personal injury or death due to exposure to flue products, including carbon monoxide.

CANADIAN VENTING REQUIREMENTS

In Canada, venting shall conform to the requirements of the current CANI-B149 Installation Codes.

Use only C.S.A. Listed 2 inch or 3 inch nominal diameter PVC or ABS pipe and fittings throughout.

The Minimum vent consists of 3 feet of straight pipe with 2 elbows (9 equivalent feet).

A single wall vent shall not be run vertically through the roof. The vent may be run through an existing unused chimney as described in the previous venting section provided the space between the vent pipe and the chimney is insulated and closed with a weather tight, corrosion resistant flashing.

Cut all vent pipe at right angles. Remove inside and outside burr at each cut. Use cleaner to clean pipe and fitting socket. Use CSA listed cement to fasten pipe and fittings.

Follow manufacturers cleaning and cementing instructions carefully to avoid leakage.

Note: *All piping exposed outdoors or in unheated areas must be insulated with 1/2 inch thick closed cell foam insulation such as "armaflex" or "insultube".*

The vent terminal shall *not* be located:

1. Less than 12 inches above the finished grade line.
2. Less than 36 inches from any building opening or any gas service regulator. (For gas service regulators in the Province of Ontario, 72 inches.)
3. Less than 72 inches from the combustion air inlet of another appliance.
4. Directly above a gas utility meter or service regulator.
5. Over a walkway unless 84 inches above grade.

VI. Combustion Air and Vent Piping (GUD - Two Pipe)

GENERAL INFORMATION AND SAFETY PRECAUTIONS



WARNING

Failure to follow these instructions can result in bodily injury or death from asphyxiation. Therefore, carefully read and follow all instructions given in this section.



CAUTION

Terminate the combustion air intake as far as is practical from the air conditioning unit or heat pump, swimming pools, swimming pool pumping units, and dryer vents.

All combustion air and exhaust piping must be installed in accordance with local codes and these instructions.

When the furnace is installed in a confined space where the minimum clearances to combustible surfaces (see Specification Sheet) are applied, such as in a closet or a utility room, two ventilation openings are required with a total minimum free area of 0.25 square inches per 1,000 BTUH of the furnace input rating. One opening must be within 12 inches of the top and one must be within 12 inches of the bottom of the confined space. In typical construction, the clearance between the door and door frame will usually be adequate to satisfy this ventilation requirement.

When the GUD furnace is installed in the same space with other gas appliances, such as a water heater, make sure there is an adequate supply of combustion and ventilation air for the other appliances. See the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1. for determining the combustion air requirements for the appliances.

The GUD furnaces are supplied with a 3 inch air intake terminal screen. This screen is shipped in the same plastic sack that held this manual. For both vertical and horizontal installations, insert the screen into the air intake terminal until it is firmly secured at the hub of the terminal elbow.

If the vent (flue) pipe is exposed to extremely cold temperatures and/or long runs through unheated spaces or outdoors, insulation may be required on the outside of the vent pipe to prevent condensate from freezing. Canadian installers must take note of the "Canadian Venting Requirements" in this section. Where required, use 1/2 inch thick closed cell foam insulation such as Armaflex or Insultube.

Note: Inspect the flue for leaks before installing any insulation.

If the combustion air pipe is to be installed above a suspended ceiling or other area where dripping of condensation will be objectionable, insulation of the combustion air pipe may be required. Where required, use 1/2 inch

thick closed cell foam insulation such as Armaflex or Insultube.

LOCATION OF EXHAUST AND INTAKE TERMINATIONS

This furnace can be installed with either a vertical or horizontal direct vent. In either case, the exhaust vent and the combustion air intake pipe must be located on the same side of the structure and separated by no less than 3 inches and no more than 24 inches.

This ensures enough distance to prevent flue gas recirculation and limits the distance to ensure the vent outlet and air inlet terminals are in the same atmospheric pressure zone.

The following points must also be considered when installing the vent pipe in either a horizontal or vertical application:

1. The vent termination must be at least 3 feet above any forced air inlet located within 10 feet.
Exception: This provision shall not apply to the combustion air intake of a direct vent furnace.
2. The vent termination must be at least 12 inches from any door, window, or gravity air inlet into any building.
3. The vent must terminate at least 2 feet above ground level or roof level. If heavy snow accumulation is expected, this distance will need to be increased.
4. The vent shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.
5. In addition, the combustion air intake should not be terminated in areas that are frequently very dusty or dirty.



CAUTION

Do not terminate the combustion air intake where the air is often heavily contaminated with compounds containing chlorine or fluorine. Common residential sources of such compounds include:

- Swimming pools and swimming pool pumps/filter
 - Clothes dryer vents
 - Remote air conditioning or heat pump units (A refrigerant leak would contaminate the combustion air.)
 - Plumbing vent stacks
 - Bathroom or swimming pool exhaust fans
 - Undried paint strippers, adhesives, paints, varnishes, sealers, waxes, and solvents. These are often used during new construction or remodeling.
- Various commercial and industrial processes may also be sources of chlorine/fluorine compounds.

HORIZONTAL VENT/INTAKE TERMINATIONS

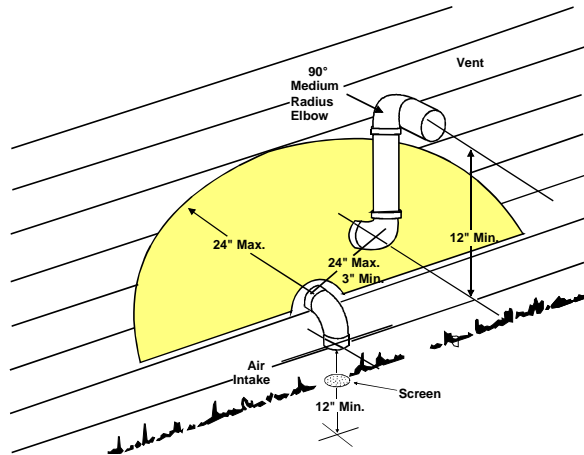


Figure 6
Horizontal Vent Termination

Position the combustion air intake terminal away from obstructions, above anticipated snow accumulations, and at least 12 inches above grade, as shown in Figure 6.

The exhaust vent must penetrate the wall within the shaded region as shown in Figure 6.

All exhaust vent and air intake terminal fittings must be medium radius (1/4 bend DWV) 90 degree elbows.

To prevent unnecessary shutdown of furnace due to pressure switch trips, always determine anticipated snow accumulation level, and install the terminals accordingly to prevent exhaust vent and air intake blockages.

If installation above snow accumulation is required, add additional elbows as shown in Figure 7. A 12 inch minimum clearance between the air intake and the highest anticipated snow level must be maintained. The exhaust vent must penetrate the wall within the shaded region as shown in Figure 7.

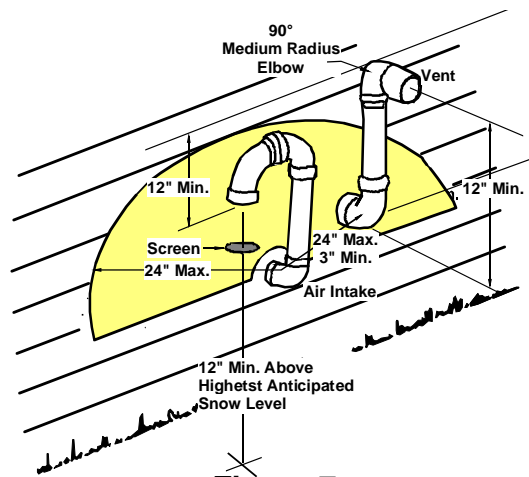


Figure 7
Horizontal Vent Termination Above Anticipated Snow Level

Do not point terminals into window wells, stairwells, alcoves or other recessed areas. It is preferable for the air intake to terminate on opposite or adjacent sides of the structure from the dryer vent. If this is not practical, maintain a 3 foot clearance (residential laundry) or a 10 foot clearance (commercial laundry).

VERTICAL VENT/INTAKE TERMINATIONS

If the vent and air intake pipes are to be run vertically through the roof, they must extend at least 12 inches above the roof line and shall be no closer than 12 inches to any vertical wall. The vent pipe must extend at least 12 inches above the air intake (See Figure 8). In areas where heavy snow accumulation is expected, these distances will need to be increased. The vent and air intake pipes must be made tight where they pass through the roof with a proper flashing such as used with a plastic plumbing vent.

Maintain at least a three foot clearance from the air intake pipe to plumbing vent stacks.

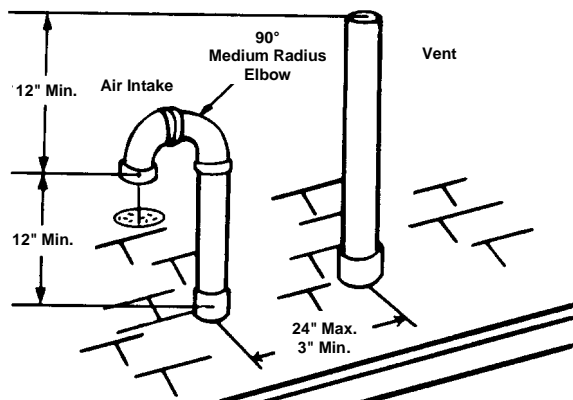


Figure 8
Vertical Vent Termination

The vent and air intake pipe may be run through an existing unused chimney. However, the pipes must be run all the way through the chimney, with the air intake pipe terminating at least 12 inches above the top of the chimney.

See Figure 9 for explanation. The flue pipe must terminate at least 12 inches above the air intake. The air intake and exhaust may run side by side or as far apart as necessary within the chimney.

The open space around the two pipes must be closed with a weather tight, corrosion resistant flashing. NEVER VENT WITH AN EXISTING APPLIANCE OR A VENT USED BY A SOLID FUEL APPLIANCE.

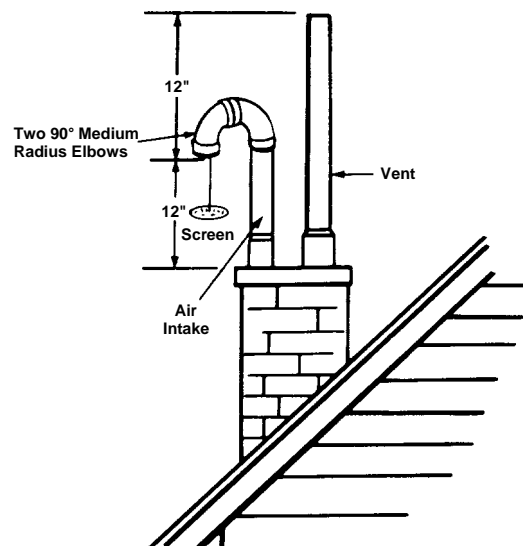


Figure 9
Venting Through Existing Chimney

VENT/INTAKE TERMINATIONS FOR INSTALLATION OF MULTIPLE DIRECT VENT FURNACES

If more than one direct vent furnace is to be installed vertically through a common roof top, maintain the same minimum clearances between the exhaust vent and air intake terminations of adjacent units as with the exhaust vent and air intake terminations of a single unit (Figure 8).

If more than one direct vent furnace is to be installed horizontally through a common side wall, maintain the clearances as shown in Figure 10. Always terminate all exhaust vent outlets at the same elevation and always terminate all air intakes at the same elevation.

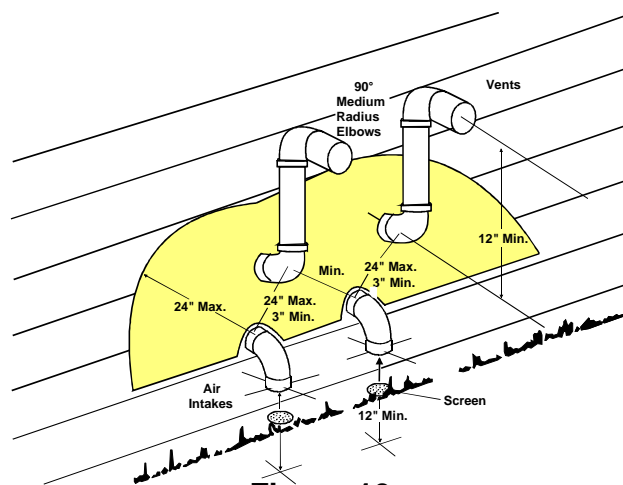


Figure 10
Horizontal Venting Of Multiple Units

EXHAUST VENT AND COMBUSTION AIR INLET PIPES SIZING

Consult Tables 1 to 3 to select the proper diameter exhaust and combustion air piping. The vent and air intake piping is sized for each unit model number based on inside piping length and number of inside 90° elbows required. Two 45° elbows are equivalent to one 90° elbow. For all piping, the elbow(s) used for vent & air pipe termination outside the

structure as shown in Figures 6, 8, and 9 are not to be counted when using Tables 1 through 3. The additional two 90° elbows as shown in Figure 7 must be counted as part of the total number of inside elbows when using Tables 1 - 3. WHEN THE VENT SYSTEM REQUIRED IS BORDER-LINE WITH NEXT SIZE COMBINATION CATEGORY, USE THE NEXT LARGER SIZE.

Important: One short radius 90° elbow is equivalent to 3-1/3 medium radius elbows. For this reason, short radius 90° elbows must not be used. The proper centerline-to-centerline dimensions for medium radius 90° elbows are shown below in Figure 11.

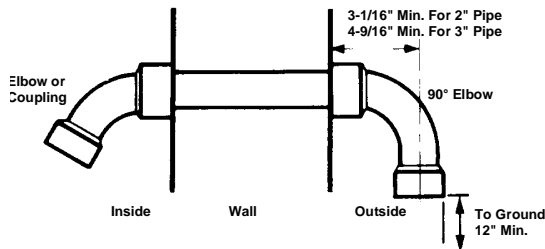


Figure 11
Medium Radius Elbow Dimensions

EXAMPLE:

An installation calls for a 45,000 Btuh furnace. It must be vented 50 inside feet and use three inside medium radius 90° elbows on both inlet and exhaust. With this in mind, we must look at Table 1 to determine the correct vent and air intake pipe size. With three elbows and 50 feet of straight pipe, 3 inch air intake pipe must be used and 2 inch vent pipe.

Important: When three inch diameter exhaust pipe is used, the transition from two inch to three inch pipe must be made in a vertical run. This is necessary for proper condensate drainage and pressure switch operation.

VENT PIPE INSTALLATION

The size of the vent and air intake pipes is determined by the heating capacity of the furnace and the length and number of elbows of the pipe runs. To properly size the pipes, refer to the previous section.

Use only the fittings, primer, and solvent cement which are described in Section IV. An air intake screen is supplied with the furnace and should be installed as shown in Figures 6-10. Do not place a screen in the exhaust vent termination. The furnace flue products could cause it to corrode.

Under some conditions, insulation of some or all of the vent pipe and/or combustion air pipe may be required. Do not install insulation until after the flue system has been inspected for leaks as described below.



WARNING

To prevent death, personal injury or property damage due to carbon monoxide, carefully inspect the entire flue system both inside and outside the furnace after installation is completed, to assure it is properly sealed and not leaking flue gases.

For each 2 inch pipe, drill a 2-3/8 inch diameter hole through the wall at the proper location.

For each 3 inch pipe, drill a 3-1/2 inch diameter hole through the wall at the proper location.

Cut a piece of PVC (ABS) pipe that is the thickness of the wall plus the depth of the sockets of the fittings to be installed on the inside and outside of the walls.

To prevent the vent pipe from moving, and possibly damaging the connections, locate the fittings on the inside wall and the elbow on the outside as shown in Figure 11 for the air intake.

In a basement installation, the pipes may be run between the joist spaces. If the pipes must go below the joists, then the pipes must run up into the last joist space to go through the header. Two 45° elbows should be used rather than 90's. The horizontal run of exhaust pipe must not have any sag that can hold condensate and should reach up at least 1/4 inch per foot so that condensate will run back to the unit to drain. Support the horizontal run at least every three feet.

Allow for some expansion and contraction from temperature fluctuations. The normal direction changes usually account for this, but if you have a long run followed by a short offset of less than 40 inches such as going up into the last joist space, the pipes should be tightly clamped to prevent flex loading on the fittings. Seal around the pipe on the outside wall with silicone caulking material.



WARNING

To prevent death, personal injury or property damage, solvent cements are combustible liquids and should be kept away from all ignition sources (i.e. sparks, open flames and excessive heat). Avoid breathing cement vapors or contact with skin and eyes.

GUD045X**B, GUD070X**B Direct Vent Venting Table																		
# of Inside Elbows	Vent Type	Inside Feet of Straight Pipe																
		5-10 Feet	10-15 Feet	15-20 Feet	20-25 Feet	25-30 Feet	30-35 Feet	35-40 Feet	40-45 Feet	45-50 Feet	50-55 Feet	55-60 Feet	60-65 Feet	65-70 Feet	70-75 Feet	75-80 Feet	80-85 Feet	85-90 Feet
1	Inlet	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA
2	Inlet	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA
3	Inlet	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA	NA
4	Inlet	2"	2"	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA	NA	NA
5	Inlet	2"	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA	NA	NA	NA
6	Inlet	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	3"	NA	NA	NA	NA	NA	NA
7	Inlet	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA	NA	NA	NA	NA	NA
8	Inlet	2"	2"	2"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA
	Exhaust	2"	2"	2"	2"	2"	2"	2"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 1

GUD090X**B Direct Vent Venting Table																		
# of Inside Elbows	Vent Type	Inside Feet of Straight Pipe																
		5-10 ft	10-15 ft	15-20 ft	20-25 ft	25-30 ft	30-35 ft	35-40 ft	40-45 ft	45-50 ft	50-55 ft	55-60 ft	60-65 ft	65-70 ft	70-75 ft	75-80 ft	80-85 ft	85-90 ft
1	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA
	Exhaust	2"	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA
2	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA
	Exhaust	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA
3	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA
	Exhaust	2"	2"	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA
4	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA
	Exhaust	2"	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA
5	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA
	Exhaust	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA
6	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA
	Exhaust	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA
7	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA
8	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2

GUD115X**B Direct Vent Venting Table																		
# of Inside Elbows	Vent Type	Inside Feet of Straight Pipe																
		5-10 ft	10-15 ft	15-20 ft	20-25 ft	25-30 ft	30-35 ft	35-40 ft	40-45 ft	45-50 ft	50-55 ft	55-60 ft	60-65 ft	65-70 ft	70-75 ft	75-80 ft	80-85 ft	85-90 ft
1	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA
	Exhaust	2"	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA
2	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA
	Exhaust	2"	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA
3	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA
	Exhaust	2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA
4	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA
5	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA
6	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA
7	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA
8	Inlet	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA
	Exhaust	3"	3"	3"	3"	3"	3"	3"	3"	3"	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3

VII. Condensate Piping



Figure 12
Standpipe Assembly

The Air Command 90 and 95 achieves its high efficiency by condensing some of the flue products into a slightly acidic water which must be piped to a drain. A standpipe, which is shipped with the furnace, must be installed on the right side of the furnace cabinet (Figure 12). The condensate from the recuperative coil and the induced draft blower flows into this standpipe which acts as a trap. No other trap may be used. A 3/4 inch PVC or CPVC pipe must be run from the side of the standpipe to a drain, maintaining a horizontal downward slope in accordance with good plumbing practices. Do not trap this line.

PVC or CPVC pipe is recommended since it is corrosion resistant, rigid, and not easily damaged. The drain line must not be routed outside where it could freeze and become blocked. The top of the standpipe must be left open so any blockage in the drainline will be relieved out the tip of the standpipe and not back up into the unit.

If an air conditioning coil is installed with the furnace, a common drain can be used (install as shown in Figure 13). Leaving an open tee near the cooling coil will allow positive air pressure in the supply air plenum be relieved out the tee without interfering with draining of the furnace condensate.

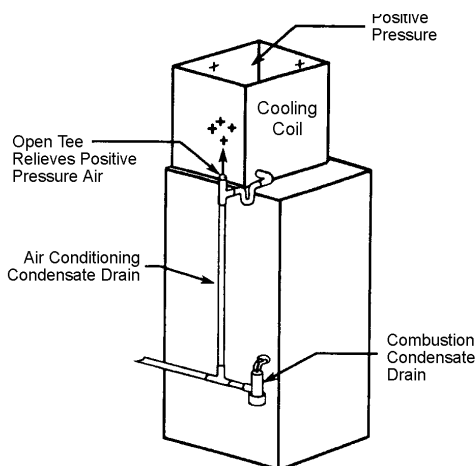


Figure 13
Common Drain Installation

VIII. Gas Piping

The rating plate is stamped with the model number, type of gas and gas input rating. Make sure the furnace is equipped to operate on the type of gas available.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 13.0" W.C.

Inlet gas pressure must not exceed the maximum value shown in table above.

The minimum supply pressure must be maintained to prevent unreliable ignition. In addition, gas input to the burners must not exceed the rated input shown on the rating plate. Overfiring the furnace could result in premature heat exchanger failure.

High Altitude Derate (U.S. Installations Only)

When this furnace is installed at altitudes above 2,000 feet above sea level the furnace input must be derated 4 percent for each 1,000 feet above sea level because the density of the air is reduced.

In some areas the gas supplier will derate the gas at a rate of 4% for each 1,000 feet above sea level. It is not done, smaller orifices will be required at altitudes above 3,500 feet (non-derated natural gas) or 4,500 feet (non-derated propane gas).

A different pressure switch is required at altitudes more than 4,000 feet above sea level. This is required regardless of the heat content of the fuel used.

High altitude kits are purchased according to the altitude and usage of either propane gas or natural gas. Refer to the Amana distributor for required high altitude kit(s).

Do not derate the furnace by adjusting the manifold pressure to a lower pressure than specified on the furnace nameplate. With a lower air density and a lower manifold pressure at the burner orifice, the orifice will not supply the proper amount of air into the burner, causing incomplete combustion of the gas, flashback, and possible yellow tipping.

GAS PIPING

Important Note: To avoid possible unsatisfactory operation or equipment damage due to underfiring of equipment, do not undersize the natural/propane gas piping from the meter/tank to the furnace. Include all appliances which may be operated simultaneously when sizing a trunk line.

The gas pipe supplying the furnace must be properly sized based on gas flow required, specific gravity of the gas and length of the run. The gas line installation must comply with local codes, or in the absence of local codes, with the latest edition of the National Fuel Gas Code, NFPA 54/ANSI Z223.1.

**Natural Gas Capacity of Pipe
In Cubic Feet of Gas Per Hour (CFH)**

Length of Pipe in Feet	Nominal Black Pipe Size				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	980
40	63	130	245	500	760
50	56	115	215	440	670
60	50	105	195	400	610
70	46	96	180	370	560
80	43	90	170	350	530
90	40	84	160	320	490
100	38	79	150	305	460

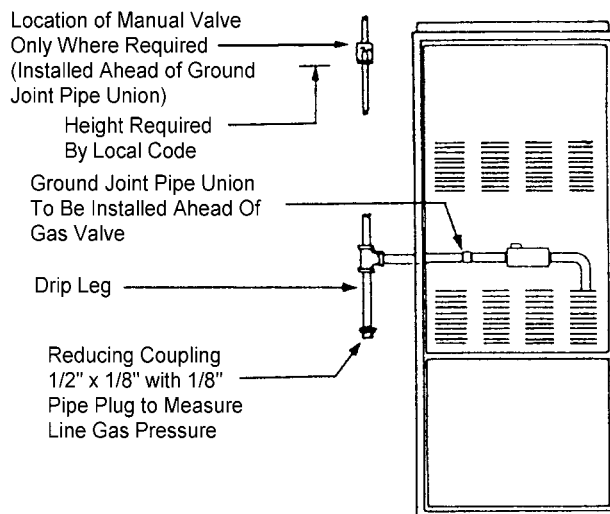
(Pressure 0.5 psig or less and pressure drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

CFH = $\frac{\text{BTUH Furnace Input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$

NATURAL GAS CONNECTION

Refer to Figure 14 for the general layout at the furnace. The following rules apply:

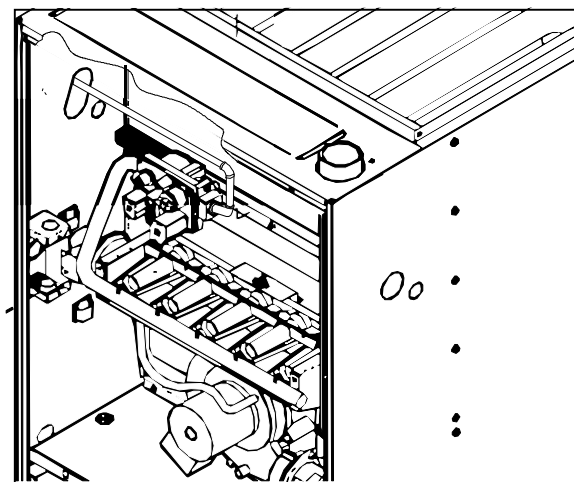
1. Use black iron or steel pipe and fittings for the building piping.
2. Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the fuel used.
3. Use ground joint unions.
4. Install a drip leg to trap dirt and moisture before it can enter the gas valve. The drip leg must be a minimum of three inches long.
5. A 1/8 inch NPT pipe plug fitting, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the furnace.
6. Use two pipe wrenches when making connection to the gas valve to keep it from turning. *The orientation of the gas valve on the manifold must be the same as shipped from the factory.*
7. Within six feet of the unit, install a manual shutoff valve between the meter and the unit. If a union is installed, the union must be downstream of the manual shutoff valve, between the shutoff valve and the furnace.
8. Tighten all joints securely.
9. The furnace must be connected to the building piping by one of the following:
 - Rigid metallic pipe and fittings.
 - Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing must not be used in exterior locations.
 - Listed gas appliance connectors, used in accordance with the terms of their listing, must be completely in the same room as the furnace.
 - The connectors or semirigid tubing must be protected against physical and thermal damage when installed. Aluminum-alloy tubing and connectors must be coated to protect against external corrosion when in contact with masonry, plaster or insulation or are subject to repeated wettings by such liquids as water (except rain water), detergents or sewage.



**Figure 14
General Furnace Layout**

When the gas piping enters through the left side of the furnace (Figure 15), the installer must supply the following fittings (starting from the gas valve):

- 90 degree elbow.
- 1-1/2 inch close nipple.
- 90 degree elbow.
- Straight pipe to reach exterior of furnace.



**Figure 15
Gas Inlet Through Furnace Left Side
(Except GUD)**

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.

When the gas piping enters through the right side of the furnace (Figures 16 and 17) the installer must supply the straight pipe to reach the exterior of the furnace.

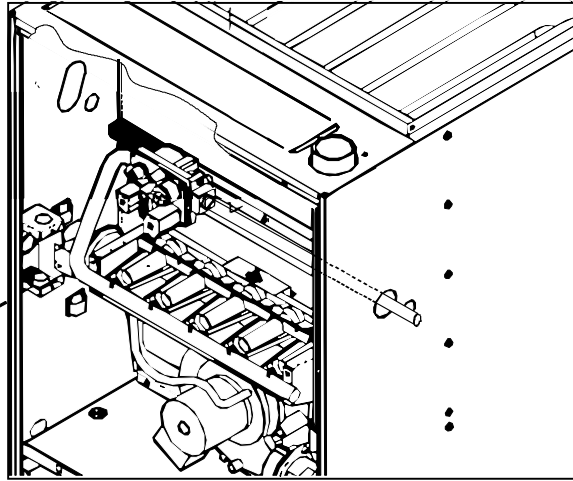


Figure 16
Gas Inlet Through Furnace Right Side
(Except GUD)

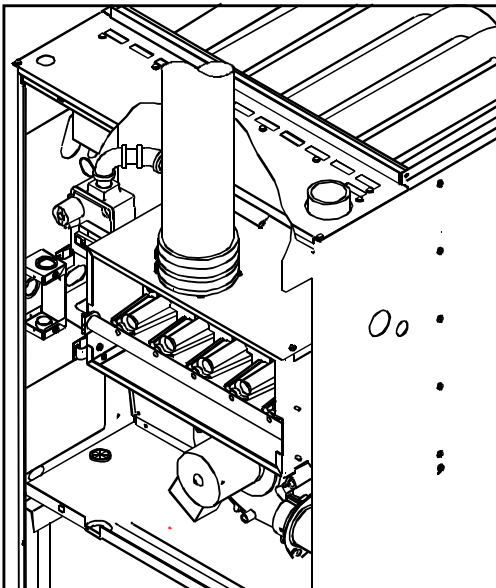


Figure 17
Gas Inlet Through Furnace Right Side
(GUD Only)

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2 inch to another pipe size.

When the gas piping enters through the right side of the furnace (Figure 18) the installer must supply the following fittings (starting from the gas valve):

- 90 degree elbow.
- 1-1/2 inch close nipple.
- 90 degree elbow.
- Straight pipe to reach exterior of furnace.

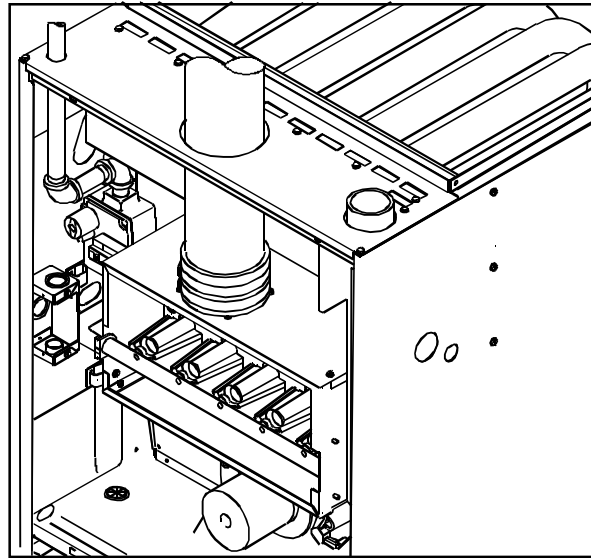


Figure 18
Gas Inlet Through Furnace Top Side
(GUD)

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2 inch to another pipe size.

GAS PIPING CHECKS



CAUTION

To prevent personal injury or property damage due to fire, the following instructions must be performed regarding gas connections, pressure testing, location of shutoff valve and installation of gas piping.

- Before placing in operation, leak test the unit and gas connections. To avoid the possibility of explosion or fire, never use a match or open flame to test for leaks. Never exceed specified pressures for testing. Higher pressure may damage the gas valve and cause overfiring, resulting in heat exchanger failure.
- This unit and shutoff valve must be disconnected from the gas supply piping system before supply piping system pressure testing with test pressures in excess of 1/2 psig (3.48 kPa).
- This unit must be isolated from the gas supply system by closing its manual shutoff valve before pressure testing of gas supply piping system with test pressures equal to or less than 1/2 psig (3.48 kPa).

TANKS AND PIPING - PROPANE GAS UNITS



WARNING

To prevent death, personal injury or property damage due to fire or explosion caused by a propane gas leak, install a gas detecting warning device. Since rust can reduce the level of odorant in propane gas, a gas detecting warning device is the only reliable way to detect a propane gas leak. Contact a local propane gas supplier about installing a gas detecting warning device.

All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters (See NBFU Manual 58).

For satisfactory operation, propane gas pressure must be 10 inch W.C. at the furnace manifold with all gas appliances in operation. Maintaining proper gas pressure depends on three main factors:

1. Vaporization rate, depending on temperature of the liquid, and "wetted surface" area of the container or containers.
2. Proper pressure regulation. Two-stage regulation is recommended for both cost and efficiency.
3. Pressure drop in lines between regulators, and between second stage regulator and the appliance. Pipe size will depend on length of pipe run and total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and propane gas suppliers.

Since propane gas will quickly dissolve white lead or most standard commercial compounds, special pipe dope must be used. Shellac base compounds resistant to the actions of liquefied petroleum gases such as Gasolac, Stalactic, Clyde's or John Crane are satisfactory.

Refer to Figure 19 for typical propane gas installations.

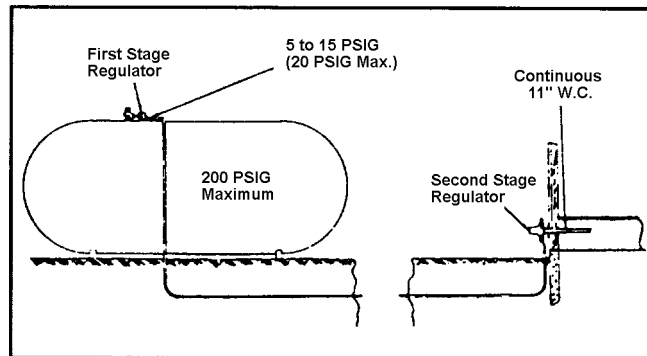


Figure 19
Propane Gas Installations (Typ.)

PROPANE GAS PIPING CHARTS

Sizing Between First and Second Stage Regulator

Maximum Propane Capacities listed are based on 2 psig pressure drop at 10 psig setting. Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40	
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"
10	730	1,700	3,200	5,300	8,300	3,200	7,500
20	500	1,100	2,200	3,700	5,800	2,200	4,200
30	400	920	2,000	2,900	4,700	1,800	4,000
40	370	850	1,700	2,700	4,100	1,600	3,700
50	330	770	1,500	2,400	3,700	1,500	3,400
60	300	700	1,300	2,200	3,300	1,300	3,100
80	260	610	1,200	1,900	2,900	1,200	2,600
100	220	540	1,000	1,700	2,600	1,000	2,300
125	200	490	900	1,400	2,300	900	2,100
150	190	430	830	1,300	2,100	830	1,900
175	170	400	780	1,200	1,900	770	1,700
200	160	380	730	1,100	1,800	720	1,500

To convert to capacities at 15 psig settings - multiply by 1.130

To convert to capacities at 5 psig settings - multiply by 0.879

Sizing Between Single or Second Stage Regulator and Appliance*

Maximum Propane Capacities Listed are Based on 1/2" W.C. pressure drop at 11" W.C. setting. Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L						Nominal Pipe Size Schedule 40				
	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
10	39	92	199	329	501	935	275	567	1,071	2,205	3,307
20	26	62	131	216	346	630	189	393	732	1,496	2,299
30	21	50	107	181	277	500	152	315	590	1,212	1,858
40	19	41	90	145	233	427	129	267	504	1,039	1,559
50	18	37	79	131	198	376	114	237	448	913	1,417
60	16	35	72	121	187	340	103	217	409	834	1,275
80	13	29	62	104	155	289	89	185	346	724	1,066
100	11	26	55	90	138	255	78	162	307	630	976
125	10	24	48	81	122	224	69	146	275	567	866
150	9	21	43	72	109	202	63	132	252	511	787
200	8	19	39	66	100	187	54	112	209	439	665
250	8	17	36	60	93	172	48	100	185	390	590

*Data in accordance with NFPA pamphlet NO. 54



WARNING

To prevent death, serious personal injury or property damage due to fire or explosion caused by a propane gas leak, install a gas detecting warning device.

If the propane gas furnace is installed in a basement, an excavated area or a confined space, a warning device is required due to:

- Propane gas is heavier than air and any leaking gas can settle in any low areas or confined spaces.
- Propane gas odorant may fade, making the gas undetectable except with a warning device.

If the presence of gas is suspected, follow the instructions on Page 2 of this manual.

IX. Electrical Wiring



WARNING

To avoid the risk of electrical shock, wiring to the unit must be properly polarized and grounded.



WARNING

To avoid electrical shock, injury or death, disconnect electrical power before changing any electrical wiring.



CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. After servicing is completed, always verify proper operation.

The wiring harness on this unit is furnished as an integral part of the furnace. Field alteration to comply with electrical codes should not be required.

LINE VOLTAGE WIRING

Power supply to the furnace must be N.E.C. Class 1, and must comply with all applicable codes. The furnace must be electrically grounded in accordance with the local codes or, in their absence, with the latest edition of the National Electrical Code, ANSI NFPA No. 70 and/or the CSA C22.1 Electrical Code. A fused disconnect should be provided and sized in accordance with the unit maximum overcurrent protection.

The *ground wire* should run all the way back to the electrical panel. To confirm proper grounding:

1. Disconnect electrical power.
2. Measure resistance between the neutral (white) connection and one of the burners.
3. Resistance should be 10 ohms or less.

On all units except GUD models, line voltage wiring must enter through the left side of the furnace. On GUD models, line voltage wiring must enter through the top or left side of the furnace. Connect hot, neutral, and ground wires as shown in the wiring diagram located on the blower door of the unit. The ground screw is located inside the junction box (Figure 20).

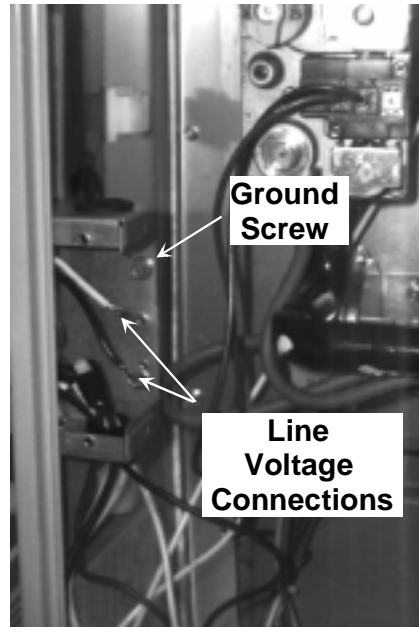


Figure 20
Field Wiring Connections - GUD
(Line Voltage)
(Shown with Junction Box Cover Removed For Clarity Only)

LINE VOLTAGE CONNECTION FOR OPTIONAL HUMIDIFIER AND ELECTRONIC AIR CLEANER

The control module in this furnace is equipped with line voltage accessory terminals to be used for controlling the power to an optional field-supplied humidifier and/or electronic air cleaner.



CAUTION

Label all wires prior to disconnection when servicing controls, wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

ACCESSORY LOAD SPECIFICATIONS

Air Cleaner: 1.0 Amp maximum at 120 VAC

Humidifier: 1.0 Amp maximum at 120 VAC

ACCESSORY INSTALLATION

Follow the electronic air cleaner and humidifier manufacturers' instructions for mounting and electrically grounding these accessories. Check that the power supply to the furnace has been disconnected. Wire the accessories to the furnace control module as shown in Figure 21. All connections to the control module are to be made through 1/4 (.250") receptacle (female) terminals.

If it is necessary for the installer to supply additional line voltage wiring to the inside of the furnace, the wiring must comply with all local codes. This wiring must have a minimum temperature rating of 105° C and must be routed away from the burner compartment. All line voltage wire splices must be made inside the furnace junction box.

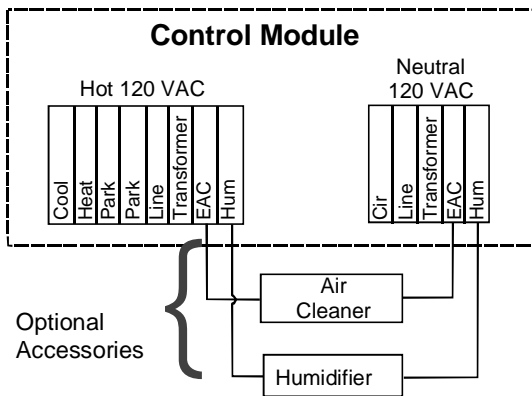


Figure 21
Accessory Operation

The furnace control module energizes the humidifier whenever the induced draft blower is energized (if there is an optional air cleaner on the system, the humidifier is not energized until the air cleaner is energized). The control module energizes the air cleaner whenever the air circulation blower is energized.

LOW VOLTAGE WIRING

Low voltage wiring may enter through the right or left side of the furnace. See Section II for hole locations. Run the thermostat wires through either hole, up through a grommet in the blower deck, and to the ignition control module (Figure 22).



CAUTION

To avoid possible equipment malfunction, be careful to route the low voltage wires so as not to interfere with filter removal or other maintenance.

Low voltage wires may then be connected to the terminal strip as shown below.

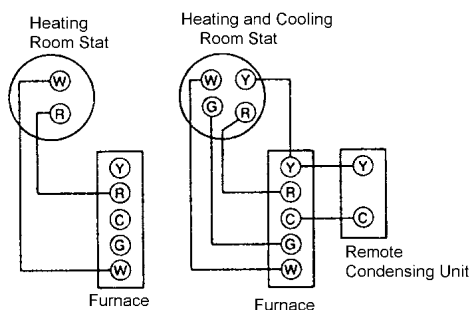


Figure 22
Typical Field Wiring
(24 VAC Control Circuit)

Adjust the heat anticipator in the room thermostat to obtain the proper number of heating cycles per hour. The heat anticipator is a wire-wound adjustable heater that prevents the room temperature from "overshooting" the room thermostat setting. The heat anticipator must be set at 0.7

amps. The heat anticipator is part of the thermostat and if it should fail for any reason, the thermostat must be replaced.

A 40V transformer and auxiliary fan relay are built into the furnace so that it may be used with most cooling equipment.

Consult the wiring diagram for both 115V and 24V wiring details. The wiring diagram is located inside the blower compartment door.

X. Circulating Air and Filters

DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the C.F.M. and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of "Air Conditioning Contractors of America" Manual D.

A duct system must be installed in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems. Pamphlets No. 90A and 90B.

The filter is designed for high velocity heating and cooling applications. Filters must be inspected, cleaned or changed every two months or as required. It is the owner's responsibility to keep air filters clean. **Note:** Dirty filters are the most common cause of inadequate heating or cooling performance.

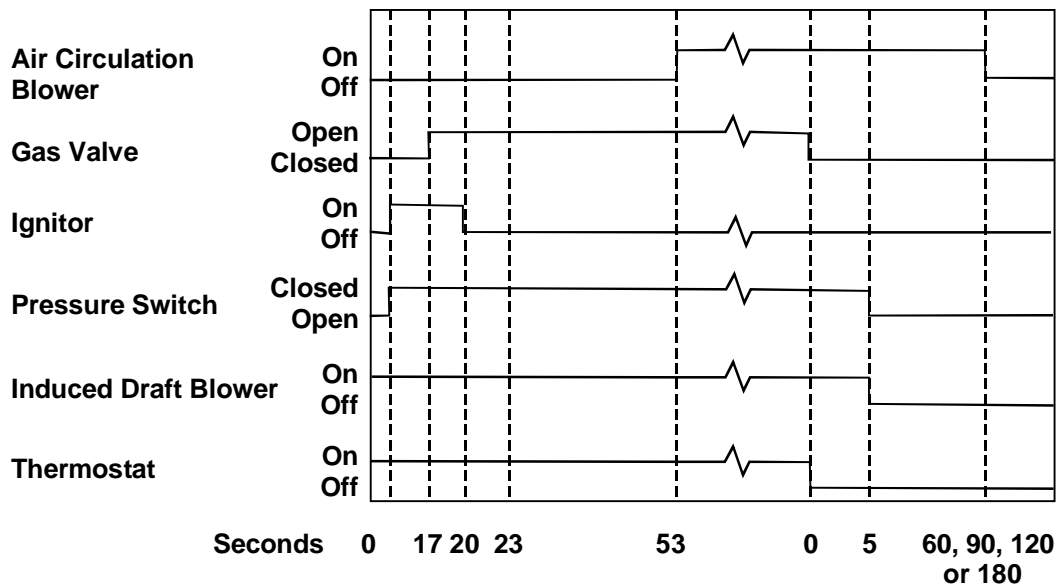
Guide dimples locate the bottom or side cutouts. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. For bottom return air connection, the bottom of the cabinet has to be removed before the furnace is positioned on the raised platform or set on top of the return air duct.

A closed return duct system must be used, with the return duct sealed to the furnace casing. Supply and return duct connections to the unit may be made with flexible joints to minimize noise transmission. If a central return is used, a connecting duct must be installed between the unit and the utility room wall so the furnace blower will not interfere with combustion air or draft. The room, closet, or alcove must not be used as a return air collecting chamber.

When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace and, if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.

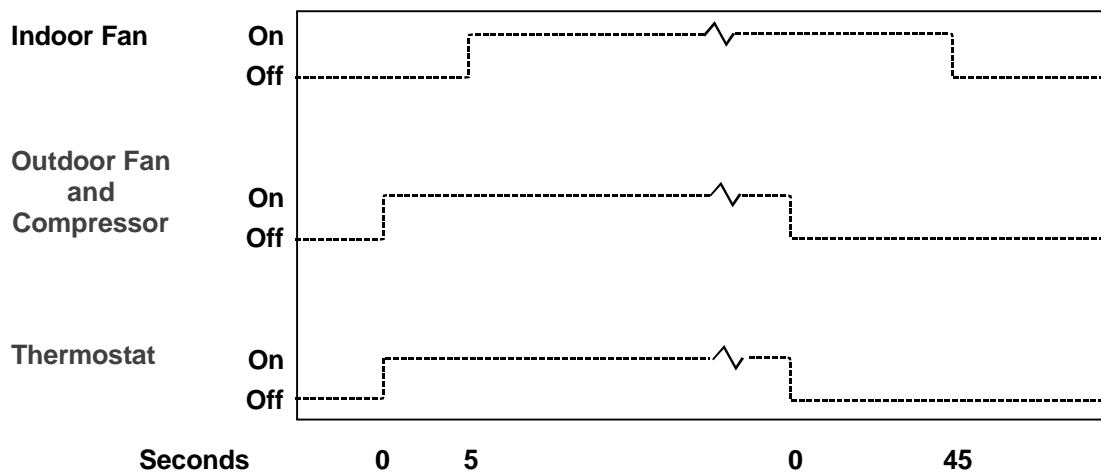
When the furnace is installed without a cooling coil, it is recommended that a removable access panel be provided in the outlet air duct. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for visual light inspection or such that a sampling probe can be inserted into the air stream. The access panel must be made to prevent air leaks when the furnace is in operation.

Timing Chart for Normal Integrated Ignition Control Operation



Integrated Control Diagnostic Light Signal Meanings	
Light Signal	Refer To "Abnormal Operation - Integrated Control" Section
Continuous Light	1. Internal Control Failure
1 Flash	2. System Lockout
2 Flashes	3. Pressure Switch Stuck Closed
3 Flashes	4. Pressure Switch Stuck Open
4 Flashes	5. Open Limit Control
5 Flashes	6. Open Roll-Out Control
Continuous Flashing	7. Flame Sensed No Call For Heat

Timing Chart for Normal Cooling Operation



When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.

XI. Sequence of Operation

NORMAL HEATING SEQUENCE

1. Thermostat calls for heat.
2. The induced draft blower is energized.
3. The ignitor is energized and is allowed to preheat for 17 seconds.
4. The gas valve is energized delivering gas to the burners and starting combustion.
5. The control checks for a signal from the flame sensor within seven seconds after the gas valve is energized. Gas will only continue to flow if a signal is present.
6. The control waits 30 seconds and turns on the air circulation blower to the speed that was selected for heating operation.
7. The thermostat is satisfied and opens.
8. The control de-energizes the gas valve.
9. After a 15-second delay while flue products are purged from the furnace heat exchanger, the induced draft blower is de-energized.
10. The air circulation blower has an adjustable delay-off timing of 60, 90, 120 or 180 seconds (starting from the time the gas valve closes). This allows more heat from the furnace to be transferred to the conditioned space. After this time has elapsed, the blower will be de-energized.

NORMAL COOLING SEQUENCE - INTEGRATED IGNITION CONTROL

With the room thermostat in the FAN-AUTO position, the indoor air circulation blower and outdoor condensing unit will be energized when a call for cooling occurs and the indoor air circulation blower will come on following a five second delay. When the call for cooling ends, the outdoor condensing unit will be de-energized. The indoor air circulation blower will continue to run for 45 seconds.

XII. Start-Up, Adjustments, and Checks

GENERAL OPERATION

This furnace is equipped with an electronic ignition device to light the burners and an induced draft blower to exhaust combustion products.

An interlock switch prevents furnace operation if the blower door is not in place. Keep the blower access doors in place except for inspection and maintenance.

This furnace is also equipped with a self-diagnosing electronic control module. In the event a furnace component is not operating properly, the control module LED will flash on and off in a factory-programmed sequence, depending on the problem encountered. This light can be viewed through the observation window in the blower access door. Refer to the Timing Charts in Section IX for further explanation of the lighting codes and Section XII, *Abnormal Operation - Integrated Ignition Control* for an explanation of the possible problem.

On new installations, or if a functional part such as the gas valve, pressure switch, or limit control has been replaced, the operation of the furnace should be checked.

Check furnace operation as outlined in the following instructions. If any sparking, odors, or unusual noises are encountered, shut off electrical power and recheck for wiring errors, or obstructions in or near the blower motors. Various shipping materials must be removed before the blower motor is operated.

ROLLOUT PROTECTION DEVICE

If the flames from the burners are not properly drawn into the heat exchanger, a protection device will open causing the gas valve to close. The protection device is located on the manifold assembly (Figure 23) on GUC and GUX models and on the burner bracket on GUD models (Figure 24). This device resets manually.

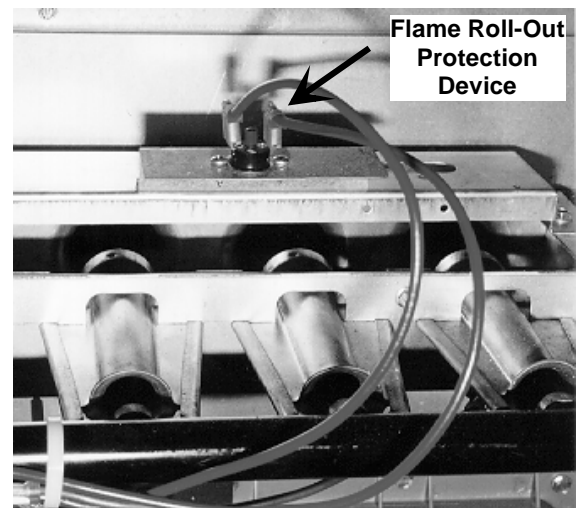


Figure 23
Roll-Out Protection Device - GUC & GUX

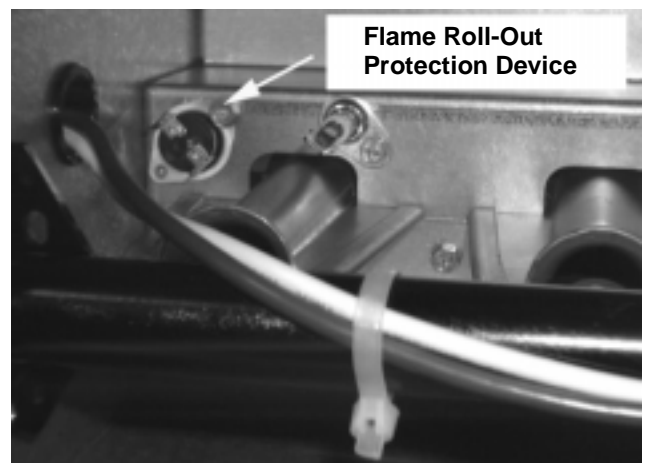


Figure 24
Roll-Out Protection Device - GUD Only



CAUTION

The cause must be investigated by a qualified servicer before any attempt is made to engage the roll-out protection device and turn the furnace back on.

ABNORMAL OPERATION - INTEGRATED IGNITION CONTROL

The following presents the probable causes of questionable furnace operation and how to fix them. Look through the observation window in the blower access door and make a note of the number of flashes in sequence between pauses. Next, refer to the Timing Charts in Section IX for an interpretation of the signals and to this section for a description.

1. Internal Control Failure with Integrated Ignition Control

An internal control failure occurs when the integrated ignition control senses an internal problem and stops the unit.

To solve this problem, replace the ignition control.

2. System Lockout

A system lockout occurs when the integrated ignition control determines that a measurable combustion cannot be established or maintained after three consecutive tries (four, if flame is established then lost) to turn on the furnace.

If a flame is not sensed during the first six seconds after a gas valve has been energized, the ignition control will internally turn off the gas. After 60 seconds, during which time the induced draft blower purges the heat exchanger, the ignitor will re-energize and preheat for 27 seconds. The gas valve is then re-energized. If a flame is not sensed again in six seconds, the gas valve will de-energize and another purge is performed. The ignition control will cycle the gas valve *three times* before it determines it cannot establish measurable combustion and enter a lockout state. If a flame is sensed but lost after 10 seconds, the control will cycle *four more times* before locking out. A lockout stops ignition attempts and causes the air blower to run continuously. The diagnostic light will indicate either condition with **one short flash** followed by a longer off.

The control can be reset and brought out of lockout mode by turning the thermostat off and then back on. It can also reset by turning off the electrical disconnect switch to the furnace for 30 seconds. The control will reset after one hour.

IMPORTANT: If you have to frequently reset your furnace, it means that a problem exists that should be corrected. Contact a qualified servicer for further information.

3. Pressure Switch Stuck Closed

A sticking pressure switch can be caused by either a faulty pressure switch, faulty wiring, a disconnected hose, or a restricted intake or flue piping. In the case of a pressure switch sticking closed, the probable cause is a faulty pressure switch or wiring.

If the ignition control senses that the pressure switch is closed and the induced draft blower is off, it will shut

down the unit until the fault is corrected. The light code for this problem is **two short flashes** followed by a longer pause.

4. Pressure Switch Stuck Open

A sticking open pressure switch can be caused by a faulty pressure switch, a disconnected hose to the pressure switch, a restricted air intake or flue piping, or a faulty wiring.

If the ignition control senses that the induced draft blower is energized but the pressure switch is not closed, the control will keep the blower on and wait for the switch to close. The diagnostic light code for this problem is **three short flashes** followed by a pause.

5. Open Limit Control

An open limit control can be caused by a low conditioned air flow due to dirty filter or resistance in duct work, a faulty blower, a blower speed set too low, or a faulty limit.

When the limit control opens, the induced draft and air circulation blowers are turned on. The induced draft blower will remain on for the first fifteen seconds of this period. The air circulation blower will remain on until the limit control is closed. The diagnostic light code for this is **four short flashes** followed by a pause.

6. Open Rollout Control

An open rollout control can be caused by insufficient combustion air, a restricted flue passage, or a restricted heat exchanger.

The opening of the rollout control signals the air circulation blower and the induced draft blower to turn on. The air circulation blower will remain on until the limit is manually reset. The induced draft blower will remain on for the first fifteen seconds of this period. The diagnostic light code for this is **five short flashes** followed by a pause.


7. Flame Sensed with No Call for Heat

If the control senses a flame when the gas valve is de-energized, it will run the air circulation blower and the induced draft blower continuously. The diagnostic light code for this is **continuous light flashing**. Probable cause is miswiring.

OPERATING INSTRUCTIONS

1. Close the manual gas valve external to the furnace.
2. Turn off the electrical power supply to the furnace.
3. Set room thermostat to lowest possible setting.
4. Remove the louvered door on the front of the furnace by turning the latch screw 1/4 turn.

NOTE: This furnace is equipped with an ignition device which automatically lights the burner. Do not try to light burner by hand.

5. *White Rodgers Model 36E36 or 36E37 or Honeywell Model VR-8205:* Turn the gas control knob clockwise  to the OFF position.

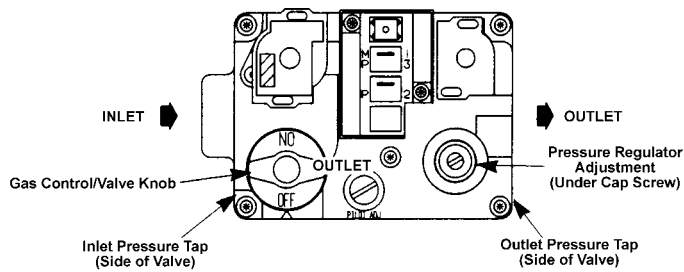


Figure 25
White Rodgers Model: 36E36 or 36E37

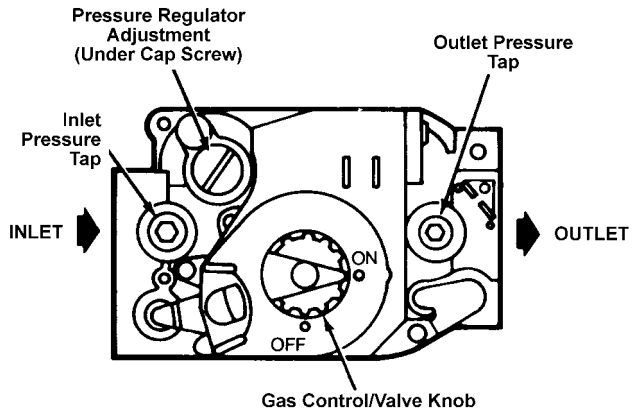


Figure 26
Honeywell Model: VR-8205

White Rodgers Model 36E22 or 36E23: Push the selector switch to "OFF".

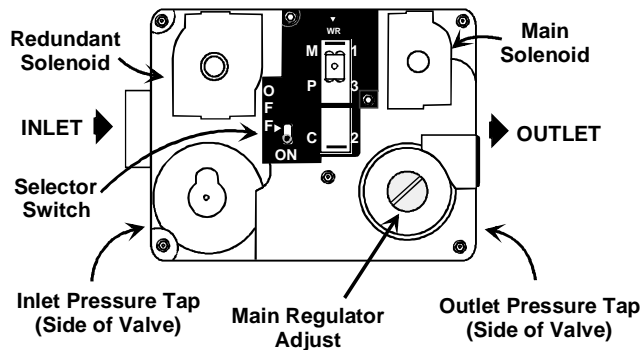


Figure 27
White Rodgers Model 36E22 or 36E23

6. Wait five minutes to clear out any gas. Then smell for gas, including near the floor. This is important, because some types of gas are heavier than air.
7. If you smell gas following the five minute waiting period in Step 6, immediately follow the instructions on Page 2 of this manual. If you do not smell gas after five minutes:

White Rodgers Model 36E36 or 36E37 or Honeywell Model VR-8205: Turn the gas control knob counterclockwise ↺ to the ON position.

White Rodgers Model 36E22 or 36E23: Push the selector switch to "ON".

8. Replace the louvered door on the front of the furnace.
9. Open the manual gas valve external to the furnace.
10. Turn on the electrical power supply to the furnace.
11. Set thermostat to desired setting.

Note: There is an approximate 20 second delay between thermostat energizing and burner firing.

CHECK GAS INPUT PRESSURES

Gas supply pressure and manifold pressure with the burners operating must be as specified on the rating plate.

CHECKING GAS PRESSURE

Gas inlet pressure should be checked and adjusted in accordance to the type of fuel being consumed.

WITH POWER AND GAS OFF

1. Connect a water manometer or adequate gauge to the "inlet pressure tap" of the gas valve (Figures 25, 26 or 27).

As an alternative method, inlet gas pressure can also be measured by removing the cap from the drip leg and installing a predrilled cap with a hose fitting.

WITH POWER AND GAS ON

2. Put furnace into heating cycle and turn on all other gas consuming appliances.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 13.0" W.C.

Inlet Gas Pressure Must Not Exceed the Maximum Value Shown in Table

If operating pressures differ from above, make necessary pressure regulator adjustments, check piping size, etc., and/ or consult with local utility.

CHECK MANIFOLD PRESSURE

A tapped opening is provided in the gas valve to facilitate measurement of the manifold pressure. ("Outlet Pressure Tap" in Figures 25, 26 or 27) A "U-Tube" manometer having a scale range from 0 to 12 inches of water should be used for this measurement. The manifold pressure must be measured with the burners operating.

To adjust the pressure regulator, remove the adjustment screw cover on the gas valve. Turn out (counterclockwise) to decrease pressure, turn in (clockwise) to increase pressure. Only small variations in gas flow should be made by means of the pressure regulator adjustment. The final manifold pressure must not vary more than plus or minus 0.3 inches water column from the specified pressure. Any major changes in flow must be made by changing the size of the burner orifice.



WARNING

To prevent death or personal injury due to carbon monoxide, all hoses must be connected as shown in Figure 28. Failure to connect the hose between the burner box and the pressure switch will result in excessive levels of carbon monoxide if the air inlet is blocked.

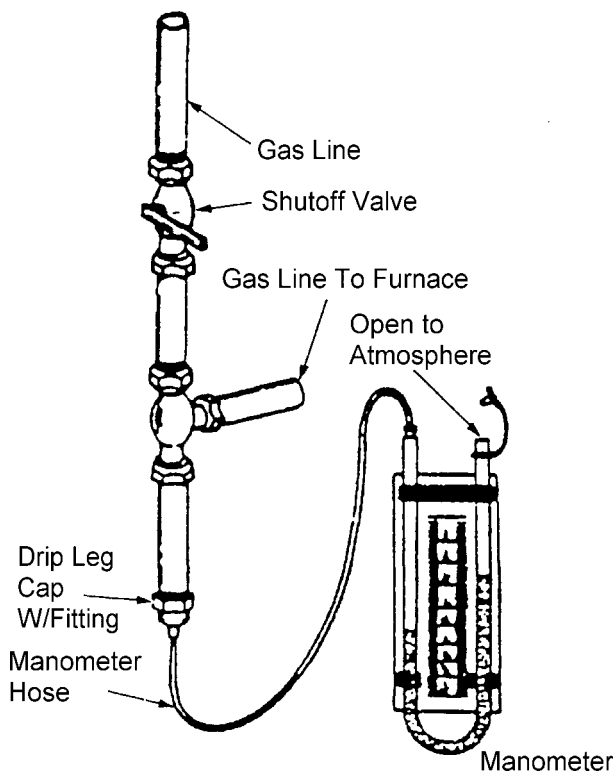
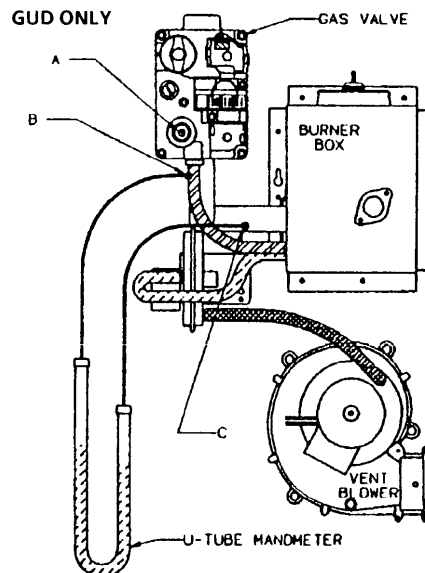


Figure 28
Measuring Inlet Gas Pressure
(Alternate Method)



- A Cap over adjustment screw must be in place when furnace is operating.
To measure manifold pressure connect manometer between B and C.
B Hose between gas valve and air box (tee supplied by servicer).
C Tapped opening in manifold (hose barb supplied by servicer).

Figure 29
Measuring Manifold Pressure
(GUD Only)

CHECK GAS INPUT (NATURAL GAS ONLY)

To measure the gas input using the gas meter proceed as follows:

1. Turn off gas supply to all other appliances except the furnace.
2. With the furnace operating, time the smallest dial on the meter for one complete revolution. If this is a 2 cubic foot dial, divide the seconds by 2; if it is a 1 cubic foot dial, use the seconds as is. This gives the seconds per cubic foot of gas being delivered to the furnace.
3. INPUT = GAS HTG VALUE x 3600 SEC. PER CUBIC FOOT (3600 is a conversion factor: 3600 seconds = one hour)

Example: Natural gas with a heating value of 1000 BTU per cubic foot and 34 seconds per cubic foot as determined by Step 2, then:

$$\begin{aligned} \text{Input} &= 1000 \times 3600 \div 34 \\ &= 106,000 \text{ BTU per Hour} \end{aligned}$$

Note: BTU content of the gas should be obtained from the gas supplier.

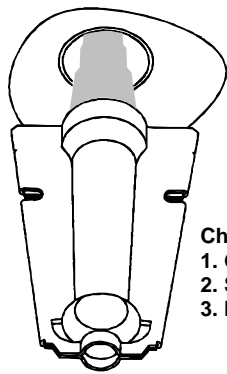
This measured input must not be greater than the input indicated on the rating plate of the furnace.

4. Relight all other appliances turned off in Step 1. Be sure all pilot burners are operating.

CHECK MAIN BURNER FLAMES

Flames should be stable, soft and blue, (dust may cause orange tips but they must not be yellow). They should extend directly outward from the burner without curling, floating or lifting off (Figure 30).

On GUD models, the flame may be inspected through the observation window on the front cover of the burner box.



Check the burner flames for:

1. Good adjustment
2. Stable, soft and blue
3. Not curling, floating, or lifting off.

Figure 30
Burner Flame

CHECK TEMPERATURE RISE

Check the temperature rise through the unit by placing thermometers in supply and return air registers as close to the furnace as possible. Thermometers must not be able to “see” the heat exchangers, or false readings could be obtained.

1. All registers must be open; all duct dampers must be in their final (fully or partially open) position, and the unit operated for 15 minutes before taking readings.
2. The temperature rise must be within the range specified on the rating plate.

Note: Air temperature rise is the temperature difference between supply and return air.

With a properly designed system, the proper temperature rise will normally be obtained when the unit is operated at rated input with the recommended blower speed.

If the correct temperature rise is not obtained, it may be necessary to change the blower speed. A higher blower speed will decrease the temperature rise. A slower blower speed will increase the temperature rise.

Note: Blower speed must be set to give the correct air temperature rise through the furnace as marked on the rating plate.

CHANGING BLOWER SPEEDS



WARNING

To avoid electrical shock, injury or death, when changing speed taps turn off power to the furnace.

A multispeed motor is used in the furnace blower. It provides easy speed selection for both heating and cooling air flow. The Specification Sheet shows the CFM and ESP relationship for proper selection of heating and cooling speeds. All furnaces ship as high speed for cooling and the speed listed on the wiring diagram for heating. These speeds should be adjusted by the installer to match the local conditions.

Refer to the WIRING DIAGRAM on the furnace to connect the correct motor leads to the correct control terminals. If

heating speed will equal cooling speed, use the jumper wire provided. All unused motor leads that are not connected to “park” terminals on the control must be taped.

CHECK LIMIT AND FAN CONTROL



WARNING


To avoid premature failure of heat exchanger or possible property damage, injury or fire, do not change the limit control, which is factory preset.

Check limit control operation after 15 minutes of operation by blocking the return air grille(s).

1. After several minutes the main burners will go OFF. Blower will continue to run.
2. Remove air restrictions. Main burners will relight after a few minutes.

TO TURN FURNACE OFF

Adjust the thermostat setting below room temperature.

1. Main burners will go OFF.
2. Circulating Air Blower will continue to run for 60, 90, 120 or 180 seconds.
3. Set the thermostat to lowest setting.
4. Turn off the electrical power supply to the furnace.
5. Remove the louvered door on the front of the furnace by turning the latch screws 1/4 turn each.
6. *White Rodgers Model 36E36 or 36E37 or Honeywell Model VR-8205 (Figures 25 and 26):* Turn the gas control knob clockwise  to the OFF position.
White Rodgers Model 36E22 or 36E23 (Figure 27): Push the selector switch to OFF.
7. Close manual gas cutoff valve external to the furnace.
8. Replace the door on the furnace.

AIR CIRCULATION BLOWER FAN TIMING

All items in this section refer to the air circulation blower fan, not to the induced draft blower. The timing sequence for the induced draft blower is not adjustable.

When a call for cooling occurs, the circulation fan will come on following a five second delay. It will remain on for 45 seconds after the call for cooling ends. This fan timing is not adjustable.

During normal heating operation, the circulation fan will come on 36 seconds after the gas valve opens. This timing is not adjustable.

As shipped, the circulation fan will remain on for 90 seconds after the gas valve closes. If desired, this timing may be adjusted. The adjustment pins or switches are near the low voltage terminal strip (see Figures 31 and 32).

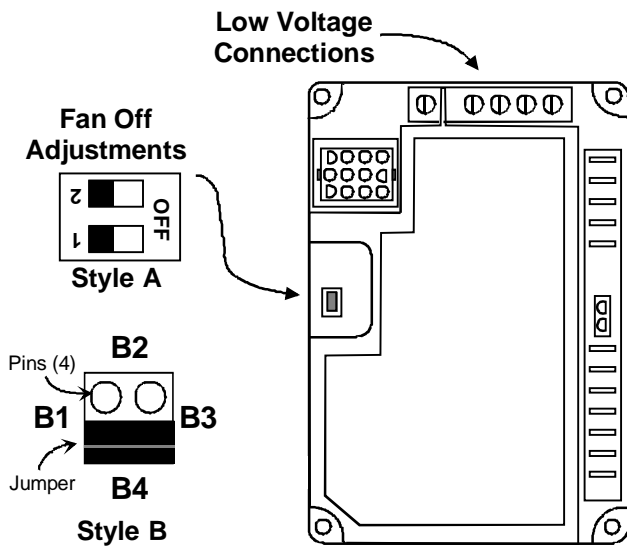


Figure 31
Ignition Control
(Viewed in an Upflow Installation)

	Style A	Style B
60 Second Delay		
90 Second Delay		
120 Second Delay		
180 Second Delay		

Figure 32
Switches
(Viewed in an Upflow Installation)

XIII. Maintenance



WARNING

To avoid electrical shock, injury or death, disconnect electrical power before performing any maintenance.



CAUTION

If you must handle the ignitor, handle with care. Touching the ignitor body with bare fingers, rough handling, or vibration could result in early ignitor failure. Only a qualified servicer should ever handle the ignitor.

Have the furnace checked at least once every year, before the heating season begins, to be sure that there is adequate combustion air and that the vent system is working properly.

Have vent pipe checked to be sure it is not blocked by debris, which could permit fumes to enter the house. Replace any leaking sections of vent pipe.

For a GUD two pipe installation, inspect the combustion air inlet screen for blockage. Clean screen when needed.

AIR FILTER



WARNING

Never operate furnace without a filter installed as dust and lint will build up on internal parts resulting in loss of efficiency, equipment damage and possible fire.

See the Specification Sheet for filter sizes.

This furnace is equipped with a permanent type washable high velocity filter(s). Filter(s) should be inspected and cleaned every two months or as required. If the replacement of the filter(s) becomes necessary, it must be replaced with a filter(s) of the same type and size.

Remember that dirty filters are the most common cause of inadequate heating or cooling performance.



WARNING

Disconnect the electrical power to the furnace before removing the filter or performing any other maintenance.

To remove the filter, turn the latches on lower door. Remove the door. The blower motor will automatically stop through the interlock switch.

The filter is designed for high velocity heating and cooling applications. Filters must be inspected, cleaned or changed every two months or as required. It is the owner's responsibility to keep air filters clean. **Note:** Dirty filters are the most common cause of inadequate heating or cooling performance.

To remove the filter contained in the furnace retaining rails, disconnect electrical power to the furnace and remove the lower door by turning the door latches 1/4 turn.

Grasp the lower portion of the filter, lift up to disengage it from the lower railing, move towards blower, drop filter down. Pull filter outward (Figure 33).

SIDE AIR RETURN

1. Lift filter above bottom rail.
2. Tilt filter to clear rail.

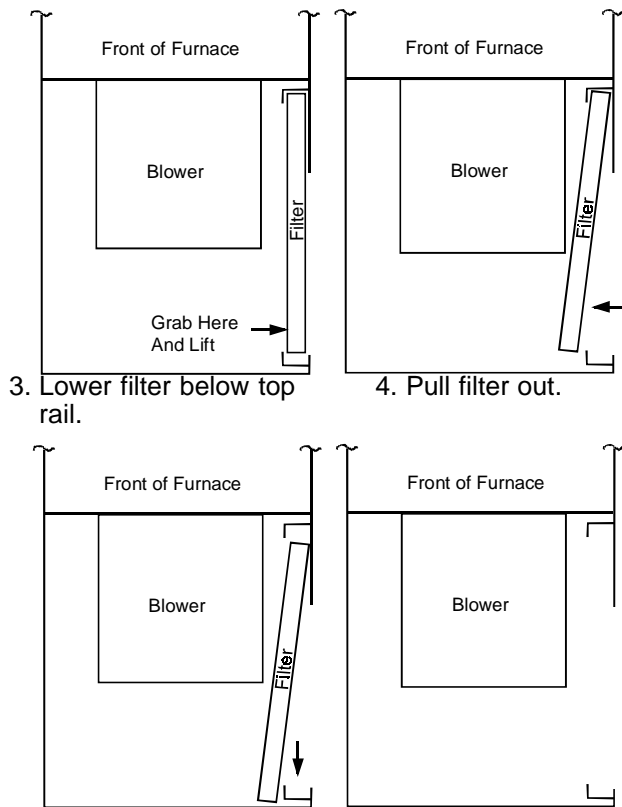


Figure 33
Filter Removal

BOTTOM AIR RETURN

The filter is held in place by a sheet metal retainer strap (Figure 34). To change and clean the filter, slide one end of the retainer towards the front and remove filter.



Figure 34
Filter Retainer

The filter must be of the permanent washable type with dimensions of 16 x 25 x 1. (Side return(s) only.)

Use a vacuum cleaner to clean out the blower area and the adjacent area of the return air duct.

Clean, wash and dry the permanent filter. Both sides should then be sprayed with a dust adhesive as recommended on adhesive container. Reinstall filter by placing it into the furnace along the side of the blower. Engage filter in the top rail, move towards side of furnace and drop it into the bottom rail. **BE SURE AIRFLOW DIRECTION ARROW POINTS TOWARDS BLOWER.**

When the filter is located in the bottom of the furnace on a bottom return system the filter is held in its location by a sheet metal retainer strap. To change or clean the filter, merely slide one end of the retainer towards the front and remove the filter.

AIR CIRCULATING BLOWER MOTOR

The air circulating blower motor bearings are permanently lubricated. No further lubrication is required.

INDUCED DRAFT BLOWER MOTOR

The induced draft blower motor bearings are permanently lubricated. No further lubrication is required.

SEALED COMBUSTION CHAMBER - GUD (QUALIFIED SERVICER ONLY)

To inspect the combustion chamber at the start of each heating season:

1. Shut off the electrical power and gas supply.
2. Looking through the observation window, check for significant amounts of dirt, soot or debris.
3. If contaminants are present, remove the cover and clean the chamber.



CAUTION

This furnace is equipped with a sealed combustion chamber. It is mandatory to replace all gaskets that are removed. Order replacement gaskets prior to starting service. Only a qualified servicer should ever open the combustion chamber.

CONDENSATE DRAINAGE SYSTEM (QUALIFIED SERVICER ONLY)

The drain tubes, standpipe, and field-supplied drain line must be checked annually and cleaned as often as necessary to ensure proper condensate drainage.

FLUE PASSAGE (QUALIFIED SERVICER ONLY)

At the start of the heating season inspect and, if necessary, clean the furnace flue passages.

CLEANING FLUE PASSAGES (QUALIFIED SERVICER ONLY)

At the start of each heating season, inspect and, if necessary, clean the furnace flue passages.

1. Turn off electrical power and the gas supply to the furnace.
2. Remove the burner assembly by disconnecting the gas line and removing the manifold brackets from the partition panel.
3. Remove the collector box insulation and then remove the collector box from the partition panel.
4. Disconnect the PVC vent from the induced draft blower so that the blower can be removed from the recuperator coil cover.
5. Remove the recuperator coil cover and remove the turbulators from the recuperator coil tubes.
6. The recuperator coil tubes can now be cleaned using a long handled round wire brush, such as a gun cleaning brush.
7. The primary heat exchanger tubes can be cleaned using a round wire brush attached to a length of high grade stainless steel cable, such as a drain cleanout cable. Attach a variable speed reversible drill to the other end of the spring cable. Slowly rotate the cable with the drill and insert it into one of the primary heat exchanger tubes. While reversing the drill, work the cable in and out several times to obtain sufficient cleaning. Repeat for each tube.
8. When all heat exchanger tubes have been cleaned and the residue removed with a vacuum, replace all the parts in the reverse order in which they were removed.
9. To reduce the chances of repeated fouling of the heat exchanger, perform the checks listed in Section XII. *Startup, Adjustments and Checks.*

FLAME SENSOR (QUALIFIED SERVICER ONLY)

Under some conditions, the fuel or air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator, causing a drop in the flame sensing signal. If this occurs, a qualified servicer must carefully clean the flame sensor with emery cloth or steel wool. After cleaning, the flame sensor output should be as listed on the specification sheet.

BURNERS



WARNING

Electrical components are contained in both compartments. To avoid electrical shock, injury or death, do not remove any internal compartment covers or attempt any adjustment. Contact a qualified service agent at once if an abnormal flame appearance should develop.

Periodically during the heating season make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes, since any dislodged dust will alter the normal flames appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.

XIV. Functional Parts List

GENERAL INFORMATION

1. When ordering any of the listed functional parts, be sure to provide the furnace model, manufacturing, and serial numbers with the order.
2. Although only functional parts, are shown in the parts list, all sheet metal parts, doors, etc. may be ordered by description.
3. Parts are available from your Amana distributor.

Gas Valve	LP Gas Orifice
Natural Gas Orifice	Blower Motor
Flame Sensor	Ignitor
Gas Manifold	Ignition Control Module
Capacitor	Pressure Switch
Induced Draft Blower	Collector Box
Limit Switch	Coil Front Cover
Flame Roll-out Switch	Recuperator Coil
Heat Exchanger	Door Switch
Transformer	Blower Relay
Blower Cutoff	Blower Wheel
Blower Housing	Filter 16 x 25 x 1, Permanent
Blower Mount Bracket	